Operating Manual

MK2430

Alarm indicator and test combination
Software version: 4.0x

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BENDER Group

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1. How to get the most out of this manual

1.1 How to use this manual

This operating manual describes the currently applicable software version of the MK2430 alarm indicator and test combination. The functions and processes described may vary from those featured in other versions. It is designed for skilled persons working in electronics and electrical engineering and in particular for those designing, installing and operating electrical equipment in the medical sector.

Chapter 7. "Operation" on page 45 can also be used as a quick reference guide by medical personnel.

Before using the equipment, please read this operating manual, the supplement entitled “Important safety instructions for Bender Products" and the instruction leaflets supplied with the individual system components. This document must be kept in an easily accessible location near to the equipment.

Should you have any further questions, please contact our Technical Sales Department. We are also happy to provide on-site service. Please contact our Service Department for more information.

Although great care has been taken in the drafting of this operating manual,. it may nevertheless contain errors and mistakes. The Bender Group cannot accept any liability for injury to persons or damage to property resulting from errors or mistakes in this manual.

1.2 Explanation of symbols and notes

The following terms and symbols are used to denote hazards and instructions in Bender documentation:

The warning symbol indicates a potential dangerous situation that may result in bodily injury and/or damage to property. Observe the associated safety instructions!

This symbol indicates important information about the correct use of the equipment purchased.
Failure to observe the associated instructions can result in equipment malfunctioning or cause problems in the environment in which it is being used.

This symbol indicates tips for using the equipment and particular useful information. This type of information will help you to optimise your use of the equipment.

2. Safety instructions

2.1 Intended use

The universal MK2430 alarm indicator and test combination is used for visual and audible indication of operating status and alarm messages from Bender's EDS, RCMS, ATICS® and MEDICS® systems.
In MEDICS® monitoring systems, the MK2430 meets the requirements of IEC 60364-7-710:2002-11 and DIN VDE 0100-710:2002-11 in respect of test functions for IT system monitoring and alarms from changeover devices. The IT system monitoring equipment can be tested using the programmable test button.

Important display functions:

- Normal operation indicator (green LED)
- Insulation fault
- Overload
- Overtemperature
- Messages from EDS… insulation fault location systems and RCMS… residual current monitoring systems
- Interruption of the phase conductor or PE conductor of the ISOMETER®
- Supply line failure
- Power supply fault conditions and changeover system faults
- Device failure
- Test results
- Measured values

The LC text display makes this information easy to understand. The connection between the MKs and the changeover and monitoring modules is implemented with bus technology. During normal operation, the MK2430 indicates the readiness for operation of the system.
The MK2430-11 features 12 digital inputs allowing messages from other technical equipment to be recorded and displayed on the MK2430, for example from medical gases or additional battery supported safety power supply systems (BSV systems).

MK2430 come into use in:

- healthcare facilities;
- industrial and office buildings;
- public buildings.

Please heed the limits of the area of application indicated in the technical specifications. Use which deviates from or is beyond the scope of these technical specifications is considered non-compliant.

Use for the intended purpose also includes:

- Device-specific settings compliant with local equipment and operating conditions.
- The observation of all information in the operating manual.
- Compliance with test intervals.

2.2 Qualified personnel

Only appropriately qualified personnel may work on Bender devices. Personnel who are familiar with the installation, commissioning and operation of the equipment and have undergone appropriate training are considered skilled persons. Such personnel must have read this operating manual and understood all instructions relating to safety.

2.3 General safety instructions

Bender devices are designed and built in accordance with the state of the art and accepted rules in respect of technical safety. However, the use of such devices may introduce risks to the life and limb of the user or third parties and/or result in damage to Bender devices or other property.

- Only use Bender equipment:
  - As intended
  - In perfect working order
  - in compliance with the accident prevention regulations and guidelines applicable at the location of use
- Eliminate all faults immediately which may endanger safety.
- Do not make any unauthorised changes and only use replacement parts and optional accessories purchased from or recommended by the manufacturer of the equipment. Failure to observe this requirement can result in fire, electric shock and injury.
- Information plates must always be clearly legible. Replace damaged or illegible plates immediately.
- Make sure that the dimension of the BSV (battery supported safety power supply), the generator set and the whole wiring is adequate. The applicable national and international standards must be observed here. Only in this way selective operation of safety devices can be achieved and a high degree of safety in case of overload and short circuit can be ensured.

2.4 Delivery conditions, guarantee, warranty and liability

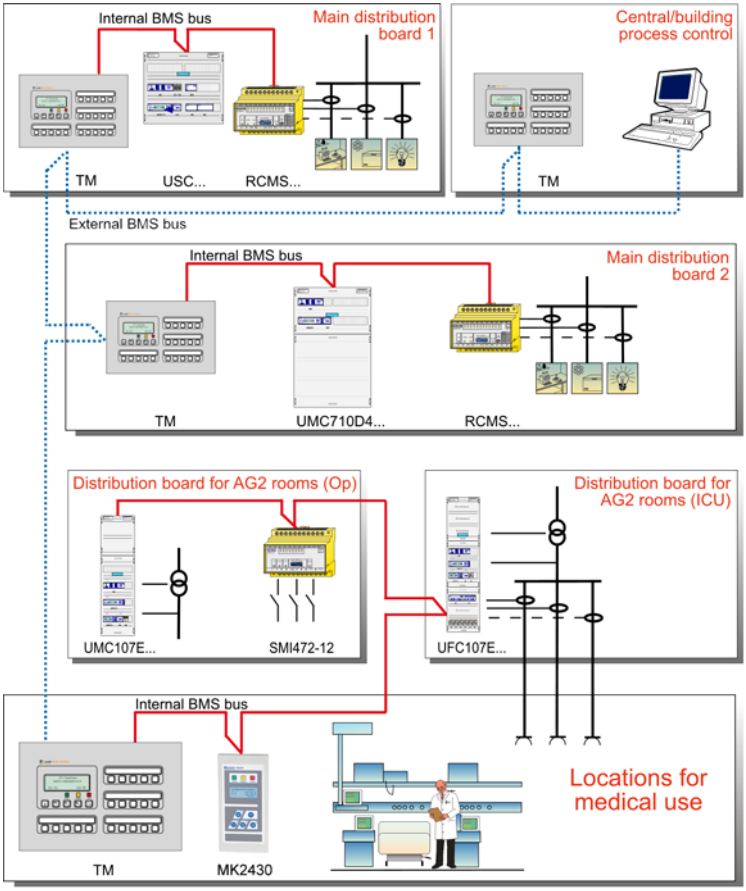
The conditions of sale and delivery set out by Bender apply. Conditions of sale and delivery can be obtained from Bender in printed or electronic format.

3. System description

3.1 MEDICS®

The MK2430 alarm indicator and test combinations are integral components of the MEDICS® system. MEDICS® is an intelligent system that guarantees safe power supply in medical locations.

Example of a section of a hospital with the MEDICS® system:



Legend to example

MK2430	Alarm indicator and test combination
RCMS	Residual current monitoring system for TN-S systems
SMI472	Signal converter for third-party systems (e.g. med. gases, BSV systems)
TM	Alarm indicator and operator panel
UFC107E…	Changeover and monitoring module for IT systems with EDS… insulation fault location system
UMC107E…	Changeover and monitoring module for IT systems
UMC710D…	Changeover module for main distribution boards
USC710D…	Control module for changeover modules (preferably in main distribution boards)

MEDICS® includes:

- Display and operating units such as TM…operator panels or MK… alarm indicator and test combinations
- Single and three-phase monitoring modules. Examples of modules in the MEDICS® system include UMC…, USC…, UFC… and EDS…. insulation fault location systems
- Communication between these components via the BMS bus (two-wire connection).
- The connection of third-party technical systems by means of protocol converters (gateways) or via digital inputs and relay outputs.

The real strength of MEDICS® is to be found in communication between all involved components and the resulting information provided to the user. The functionality of the equipment is continuously monitored. Operating states, irregularities, faults and equipment failures are displayed. This means high operational reliability of the installation for the user.

3.2 Features

On its backlit LC display (4 x 20 characters), the MK2430 displays messages from all BMS bus devices assigned via alarm addresses. As well as being used as a standalone indicator, the MK2430 also supports parallel indication in different rooms.
In the event of an alarm message the yellow "WARNING“ LED or the red "ALARM" LED lights up and the message appears on the LC display in plain text format. At the same time there is an audible signal (acknowledgeable/can be switched to mute). If a second message is received whilst the first is still pending, the audible signal will sound again

and the messages will flash up alternately on the LC display. The address of the device triggering the alarm can also be called up. The audible signal sounds again once a configurable period of time has elapsed (repetition can be deactivated).

Internal device parameters (alarm addresses, test addresses,…) and the parameter setting for EDS and RCM systems can be accessed via the menu system. As a master, the MK2430 can also be used as master device in installations with a number of IT and EDS systems.
The test button can be used to check the operation of the associated devices (e.g. insulation monitoring devices, LIM (Line Isolation Monitors) or GFCI (Ground Fault Circuit Interrupters). A message is output only on the MK2430 on which the test button "TEST" was pressed. The test and its individual evaluations are carried out sequentially. Once the process is complete, a message indicating that the test has been successful or a fault message is output.

MK2430 features:

- Display of operating status, warning and alarm messages in accordance with IEC 60364-7-710:2002-11, DIN VDE 0100-710:2002-11 and other standards
- Backlit clear LC text display (4 x 20 characters)
- Standard texts for messages in 20 languages
- 200 freely programmable message texts (with TMK-SET PC software)
- Bus technology for easy installation and reduced fire load
- Audible alarm (can be acknowledged or set to mute)
- Menu-based parameter setting (German/English): MK2430 basic parameters and EDS46x, EDS47x, EDS49x, RCMS460, RCMS470, RCMS490 via BMS bus
- Types available for flush and surface mounting
- Easy commissioning due to predefined alarm text messages
- 12 Digital inputs (MK2430-11 only)
- History memory with real-time clock to store 250 warnings and alarms
- Replaces the MK2418

3.3 Functionality

3.3.1 Display/operating elements

The backlit display features four lines of 20 characters. It supplies medical and technical personnel with information that is always clear and unambiguous, in order to help them to make decisions. Every alarm message comprises three lines which appear spontaneously and three additional lines which can be displayed at the touch of a button. The fourth line contains status information (number of messages, test procedures, menu information). Three LEDs are located above the text display. They indicate:
Normal operation (green), warnings (yellow) or alarms (red).
Five buttons are available for acknowledging or setting alarms to mute and warnings, for testing the associated devices and for the menu system.

3.3.2 Programming

Standard message texts can be activated by enabling alarm addresses. These texts are available in 20 languages. Alarm addresses can be enabled via the device menu system (without PC). Individual message texts, each comprising 6 lines of 20 characters can be programmed with the TMK-SET software.
An LED (yellow or red) and an audible signal can be assigned to each message. For this purpose, the PC is connected to the USB interface or BMS bus (RS-485).

3.3.3 History memory

Warnings and alarms are written to the history memory automatically with date and time stamp. 250 text messages can be saved. After this, each subsequent message then overwrites the oldest message in the history memory (message 251 will overwrite message 1 etc.). The history memory can be read out via the operating menu or the TMK-HISTORY PC software.

3.4 Versions

3.4.1 MK2430-12

The MK2430-12 is used for visual and audible indication of alarms from Bender's EDS, RCMS and MEDICS® systems and for testing assigned devices (e.g. insulation monitoring devices, LIM, GFCI). Furthermore, the MK2430-12 can also be used as parallel indication in conjunction with MK2430-11 resp. SMI472-12. The programmed message texts are displayed on the LCD in the selected language.

3.4.2 MK2430-11

The MK2430-11 features all the functions of the MK2430-12 plus 12 digital inputs and a programmable relay output. All digital inputs are electrically isolated in three groups of 4. The input voltage is AC/DC 10…30 V / 2…5 mA (HIGH = 10…30 V; LOW = 0…2 V). In practice, these digital inputs (IN1… IN12) are controlled via potential-free contacts (N/C or N/O operation configurable). The voltage required for these inputs is provided via the power supply unit, which also supplies power to the MK2430. Any message text can be assigned to the inputs.

3.4.3 MK2430P-…

The MK2430P-… contains the programming of the standard display and the factory activation of up to 20 alarm addresses. A line containing a note about the assigned equipment can be programmed individually for each alarm address. This line appears as the first line in an alarm.
For many applications with medical IT systems, this programming scope is sufficient. A programming template in the shape of a form is available for customer-specific programming.

Furthermore, up to 200 individual alarms can be programmed in the factory subject to an additional fee. This type of programming is recommended for EDS, RCMS, medical gases or BSV systems.

3.4.4 Interfaces

MK2430 feature a BMS bus and USB interface.

3.4.4.1 BMS bus

The internal BMS bus is used for communication with MEDICS® components,

- e.g. modules such as UMC…, UMA…, UFA…, UFC…, LFC..
- or devices like RCMS…, EDS…, SMI…, SMO…, ATICS®, alarm indicator and operator panels.

The MK2430 is the master whenever the address is set to 1. An address setting of 2…150 denotes operation as a slave.

The Master is responsible for specific tasks:

- As a "master clock", it synchronises the time of all devices on the internal BMS bus
- It controls data traffic on the BMS bus.

In order to program the MK2430, a PC must be connected

- to the BMS bus either via an RS-232/RS-485 adapter
- or to a USB/RS-485 adapter.

3.4.4.2 USB interface

A PC can also be connected to the MK2430 via the USB interface with a USB cable (Type A plug onto Type B plug). The interface can only be accessed when the MK2430 has been removed.

Only the connected MK2430 can be read out and set via the USB interface.

Optional software

- You can use the the TMK-SET PC software to display and change the MK2430 settings.
- You can use the PC software TMK-HISTORY to read out the MK2430 history memory.

4. Installation and connection

4.1 Installation

4.1.1 Overview of enclosures

– The MK2430 in flush-mounting enclosure (with a special mounting kit) also suitable for installation in a panel or cavity wall
– MK2430A in surface-mounting enclosure

4.1.2 Dimension diagram flush-mounting enclosure

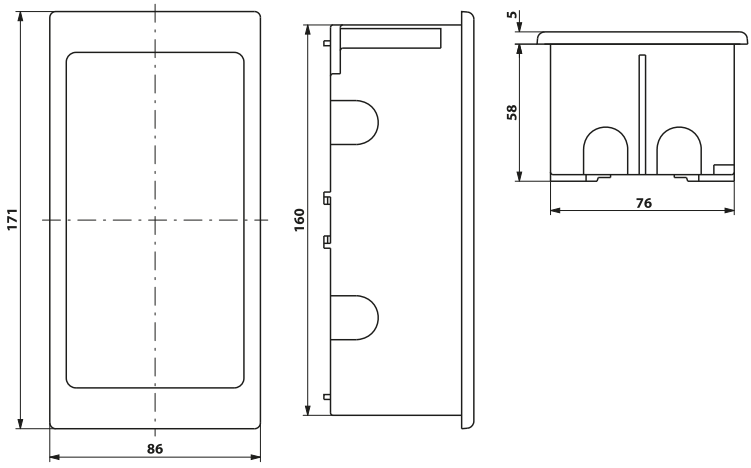


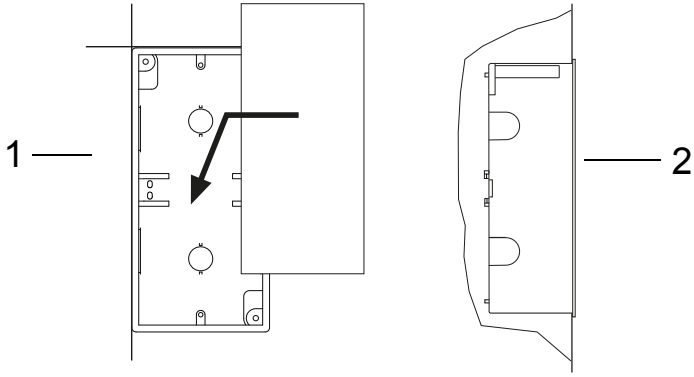
Fig. 4.1: MK2430 in flush-mounting enclosure
front panel cut-out: 161 x 77 mm

The MK2430 is mounted in its enclosure by means of clips. In addition, the MK2430 can be secured in its enclosure with screws. For this purpose, markings for the drilling holes are prepared at the rear of the front plate: drilling hole: 3 mm ∅ , counterboring: 6 mm ∅).

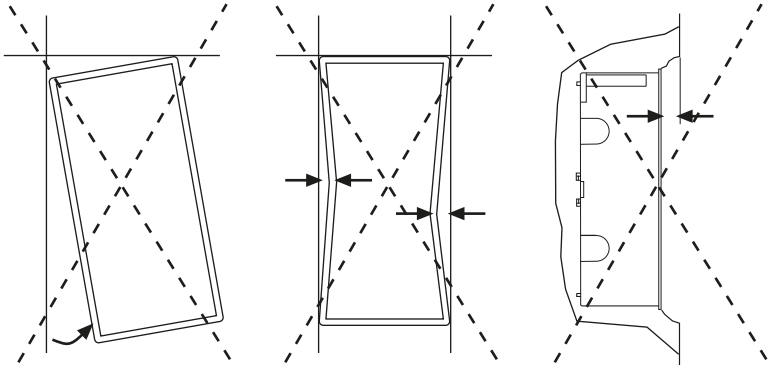
4.1.2.1 Flush-mounting

The flush-mounting enclosure is already enclosed in the scope of delivery of MK2430.

1. Insert the supplied cardboard into the flush-mounting enclosure to improve the shape stability and to provide protection against pollution.
2. Insert the enclosure so that it is flush with the wall surface.

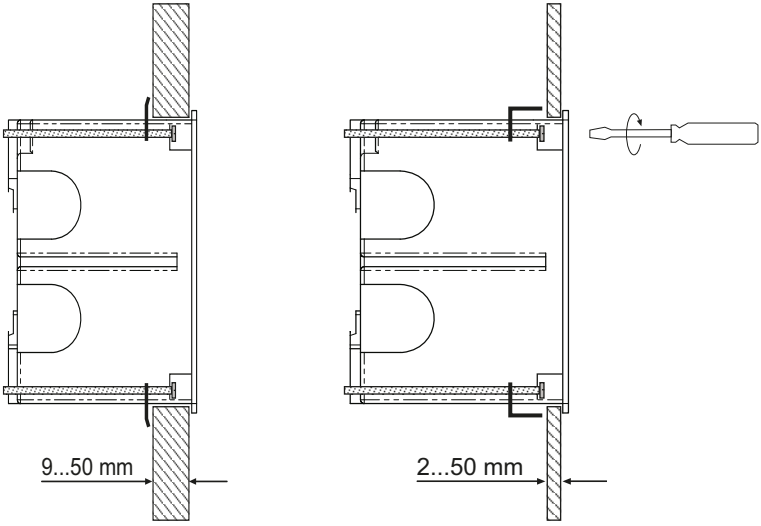


The flush-mounting enclosure must not be installed lopsidedly or warped, and must not be installed too deep below the surface.



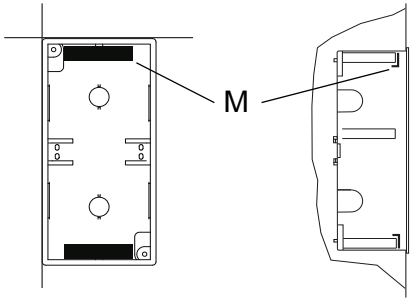
4.1.2.2 Cavity wall and panel mounting

For cavity wall or panel mounting you will need a "Complete mounting kit" (Art. No. B95101000).



4.1.2.3 Mounting brackets

Use the laterally attached mounting clips to snap the MK2430 into the flush-mounting enclosure. Two mounting brackets (M) are used for additional support. They are needed in particular if the MK2430 is to be fixed into an existing flush-mounting enclosure (e.g. MK2418) which is not intended for snap-on mounting. This requires "Complete mounting kit" (Art. No. B95101000)“.



4.1.3 Dimension diagram surface-mounting enclosure

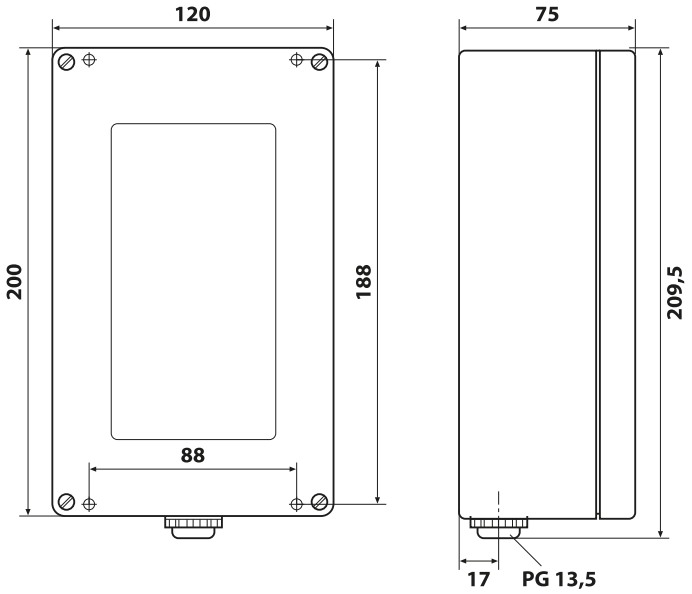


Fig. 4.2: MK2430 in surface-mounting enclosure

4.1.3.1 Installation of the surface-mounting enclosure

A smooth and even surface is a precondition for installation. Only use fastening screws of the size specified below. Failure to observe this can result in deformation or damage to the enclosure.

- Use the empty enclosure as a template for marking the drilling holes
- Maximum diameter of the screws:
  Thread of screw 3 mm, bolt head 7 mm

4.2 Connections

Risk of electric shock!
Before fitting the enclosure and working on the device connections, make sure that the power supply has been disconnected and the system is dead.
Failure to comply with this requirement will expose personnel to the risk of electric shock. Furthermore, the electrical installation may sustain damage and the device may be destroyed beyond repair.

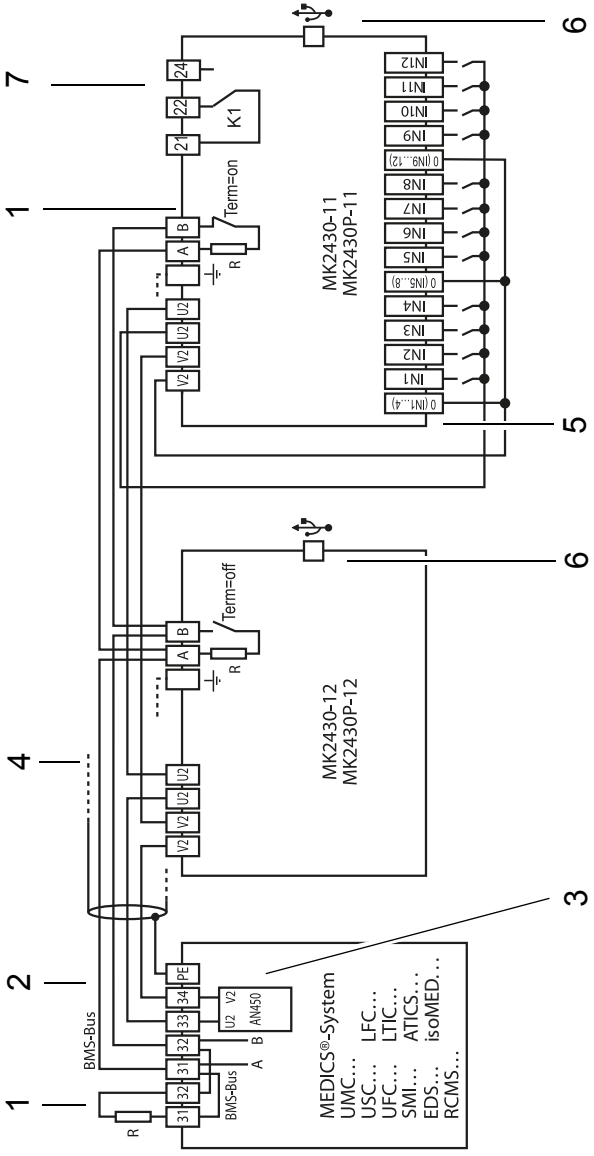
*You must only connect the MK2430 as illustrated in the diagram in this chapter. Do not make **any changes to the internal wiring**. Non-compliant connection or arbitrary changes can lead to serious malfunctions or even the complete failure of the MK2430.*

*The device contains components that can be **damaged by electrostatic discharges (ESD)**. When work activities are carried out at the opened device, the safety precautions for the dissipation of electrostatic electricity have to be observed..*

4.2.1 Notes on connection

- Connect the MK2430 to the supply voltage (terminals U2/V2).
  - If you are connecting the MK2430 to a DC 24 V supply: take the line voltage drop into account if you are using long supply cables for the supply voltage.
  - Consider the maximum permissible cable lengths for the supply voltage U2/V2 when using an AN450 or AN410 power supply unit (refer to "Technical data").
- The connection to the internal BMS bus is made via the terminals A/B. Connect the BMS bus as described on the "BMS bus" instruction leaflet. Use a shielded cable of at least mm or 0.8 mm cross section for the interface line (e.g. J-Y(St)Y n x 2 x 0.8). Connect the shield to PE at one end. When wiring the bus connection, please note that a 4-wire cable (2 x BUS, 2 x US) with suitable cross section is required when routing the supply voltage U_S.
- Set the terminating resistor for the BMS bus on the "Term" DIP switch. Factory setting: off.
- MK2430-11 only: Use cables with a cross section of at least 0.75 mm ^{2} when connecting the digital inputs and the relay output. The maximum cable length per connection is 500 m.

4.2.2 Wiring diagram



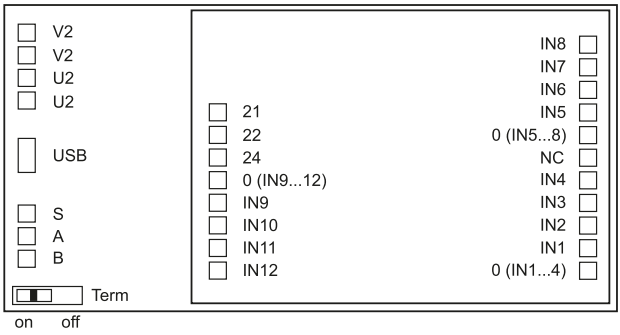
Legend to wiring diagram

1	Terminating resistor: If two or more devices are connected to each other via the BMS bus, each bus line must be terminated with a resistor (R = 120 Ω) at the start and end of the BMS bus (can be connected via DIP switch on the MK2430 and alarm indicator and operator panel.
2	BMS bus connection: A variety of Bender devices with a BMS bus can be connected to the BMS bus. These may include: 107TD47 insulation monitoring devices, PRC487 control devices, RCMS470 residual current evaluators and many more.
3	Power supply unit in the MEDICS® module, sufficient for supplying power to at least three MK2430.
4	Cable between the MEDICS® module and MK2430. Please observe the permissible cable lengths and cross sections when using the AN450 power supply unit in MEDICS® modules.
5	Digital inputs. The digital inputs may be controlled either via internal or external voltage or potential-free contacts. If the inputs are controlled via an external voltage, the common 0(-) is applied to terminal "0" and the 1(+) signal to the relevant input IN1 … IN12. In this case, the connections between the terminals 0 and V2 and the common connections and U2 are not required.
6	USB interface. For PC connection. The TMK-SET PC software is used to programme the MK2430. You can use the PC software TMK-HISTORY to read out the MK2430 history memory.
7	MK2430-11 only: Relay output. Programmable contact for device errors, test of assigned devices*, device failure and common alarm message.

** Devices without BMS bus connection, but with test input (e.g. ISOMETER®)*

4.2.3 Connection assignment

The connections are located on the rear of the devices.



4.2.3.1 MK2430-12

The MK2430-12 features a single terminal strip as it receives all messages via the BMS bus. It receives these messages for example from the 107TD47, an MK2430-11, the signal converter SMI47x, the EDS… or the RCMS…

U2, V2	Supply voltage U_S : looped through connection for the supply voltage U_S. Note:. **Note: Make sure that the power supply of MK2430 is isolated against PE. If this is not taken into consideration and if a PC is connected to the USB interface, the MK 2430 device and the PC may sustain damage**
USB	USB connection. Cable: Type A plug on type B plug.
S	BMS bus and USB interface shield.
A, B	BMS bus
Term	BMS bus terminating resistor, switchable

4.2.3.2 MK2430-11

The MK2430-11 alarm indicator and test combination provides additional terminal strips for the 12 digital inputs and one optional relay output.

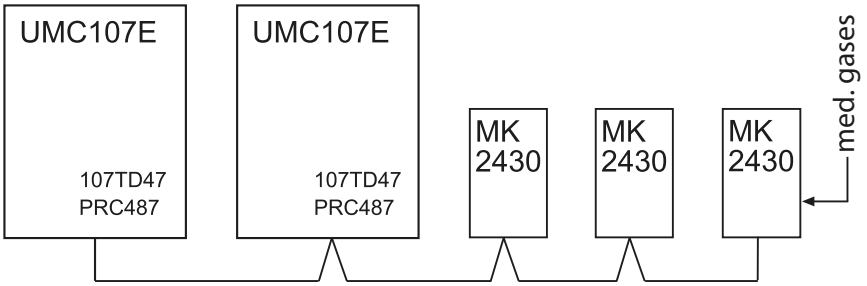
IN1…IN12	Digital inputs 1…12
0 (IN1…4)	Common connection"0" for the digital inputs 1…4
0 (IN5…8)	Common connection"0" for the digital inputs 5…8
0 (IN9…12)	Common connection"0" for the digital inputs 9…12
21, 22, 24	Relay output (option)
NC	no function (not connected)

Also refer to “Settings menu 5: Digital inputs (MK2430-11 only)” auf Seite 60.

4.3 Examples for BMS bus connection and addressing

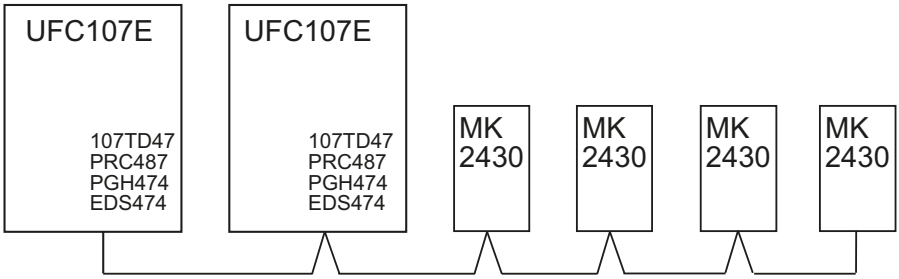
Missing or incorrectly installed terminating resistors (e.g. in the middle of the bus) will cause bus instability. Please also note the information on the "BMS-Bus" operating manual.

Example 1: Operating theatre or intensive care unit with two IT systems and three rooms



Device	Parameters	Address settings
First changeover and monitoring module UMC107E		
107TD47	Bus address	3
PRC487	Bus address	4
Second changeover and monitoring module UMC107E		
107TD47	Bus address	5
PRC487	Bus address	6
Alarm indicator and test combinations		
First MK2430…	Bus address	1
	Test address	3, 5
	Alarm address	2, 3, 4, 5, 6, 7
Second MK2430…	Bus address	2
	Test address	3, 5
	Alarm address	1, 3, 4, 5, 6, 7
Third MK2430…	Bus address	7
	Test address	3, 5
	Alarm address	1, 2, 3, 4, 5, 6

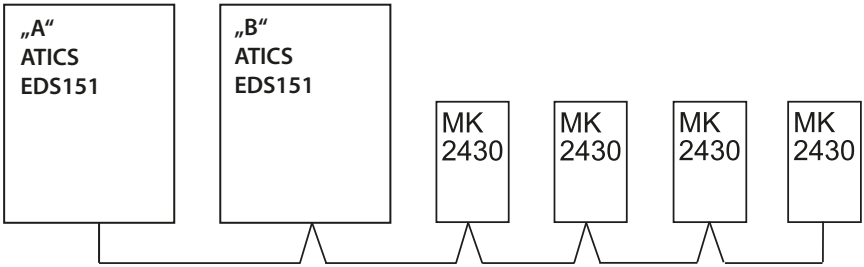
Example 2: Intensive care unit with two IT systems and four rooms



Device	Parameters	Address settings
First UFC107E switchover and monitoring module		
107TD47	Bus address	3
PRC487	Bus address	4
PGH474	Bus address	111
EDS474-12	Bus address	61
Second UFC107E switchover and monitoring module		
107TD47	Bus address	5
PRC487	Bus address	6
PGH474	Bus address	112
EDS474-12	Bus address	62
Alarm indicator and test combinations		
First MK2430…	Bus address	1
	Test address	3, 5
	Alarm address	2, 3, 4, 5, 6, 7, 8, 61, 62, 111, 112

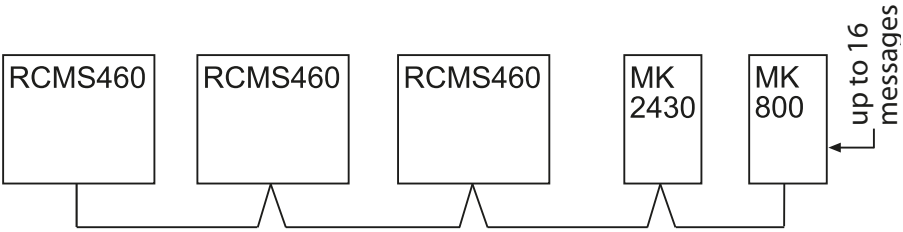
Device	Parameters	Address settings
Second MK2430…	Bus address	2
	Test address	3, 5
	Alarm address	1, 3, 4, 5, 6, 7, 8, 61, 62, 111, 112
Third MK2430…	Bus address	7
	Test address	3, 5
	Alarm address	1, 2, 3, 4, 5, 6, 8, 61, 62, 111, 112
Fourth MK2430…	Bus address	8
	Test address	3, 5
	Alarm address	1, 2, 3, 4, 5, 6, 7, 61, 62, 111, 112

Example 3: Intensive care unit with two IT systems and four rooms



Device	Parameters	Address settings
First switchover and monitoring module		
ATICS "A"	Bus address	3
EDS151 "A"	Bus address	4
Second switchover and monitoring module		
ATICS "B"	Bus address	5
EDS151 "B"	Bus address	6
Alarm indicator and test combinations		
First MK2430…	Bus address	1
	Test address	3, 5
	Alarm address	2, 3, 4, 5, 6, 7, 8
Second MK2430…	Bus address	2
	Test address	3, 5
	Alarm address	1, 3, 4, 5, 6, 7, 8
Third MK2430…	Bus address	7
	Test address	3, 5
	Alarm address	1, 2, 3, 4, 5, 6, 8
Fourth MK2430…	Bus address	8
	Test address	3, 5
	Alarm address	1, 2, 3, 4, 5, 6, 7

Example 4: System with 3 RCMS, one MK2430 and one MK800



Device	Parameters	Address settings
Residual current evaluators		
1. RCMS460	Bus address	3
2. RCMS460	Bus address	4
3. RCMS460	Bus address	5
Alarm indicator and test combinations		
MK2430…	Bus address	2
	Test address	-
	Alarm address	1, 3, 4, 5
MK800…	Bus address	1
	Test address	-
	Alarm address	2, 3, 4, 5,

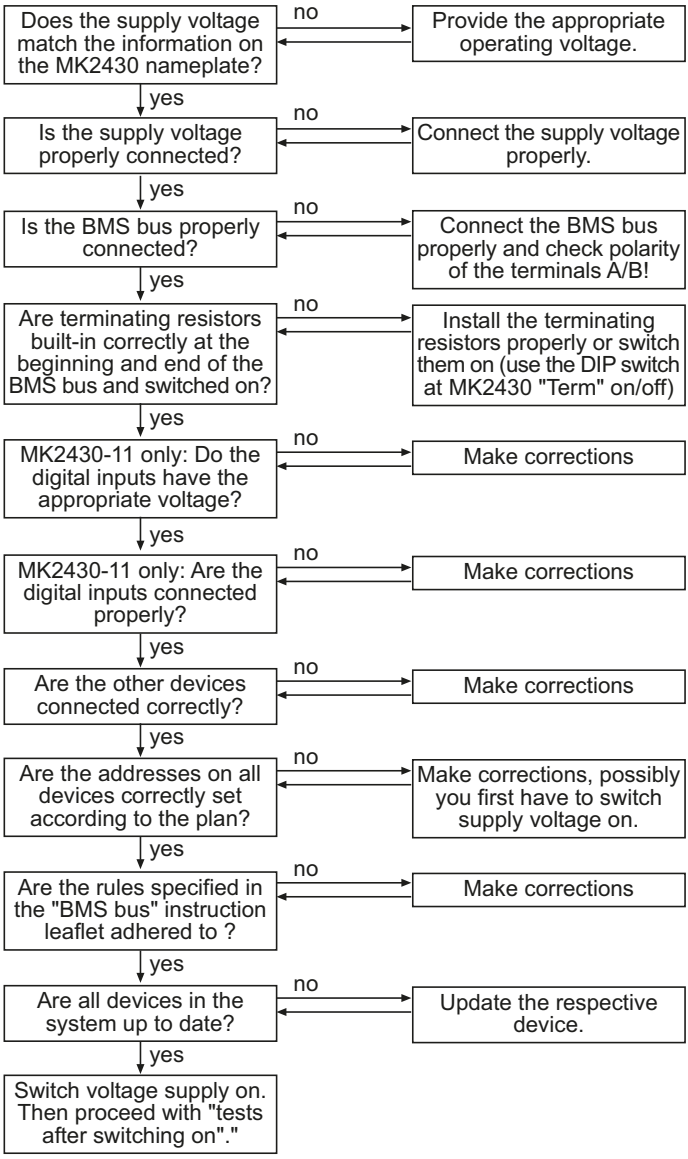
5. Commissioning and testing

Accomplish start-up according to the following start-up patterns:

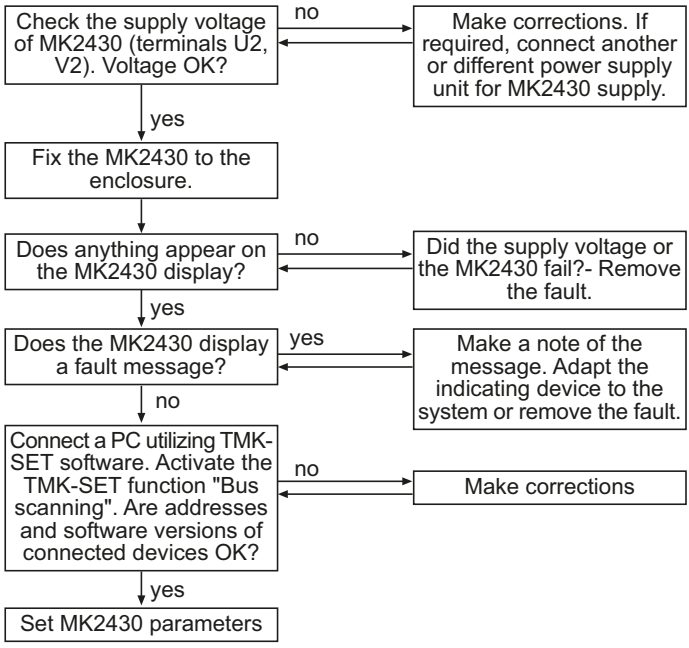
1. Tests before switching on
2. Tests after switching on
3. Make parameter settings
   - Settings at the MK2430
   - Settings in the software TMK-SET
4. Tests after parameter setting

Please note down all settings and attach these to the equipment or installation documentation.

5.1 Tests before switching on


Does the supply voltage match the information on the MK2430 nameplate?
no
Provide the appropriate operating voltage.
yes
Is the supply voltage properly connected?
no
Connect the supply voltage properly.
yes
Is the BMS bus properly connected?
no
Connect the BMS bus properly and check polarity of the terminals A/B!
yes
Are terminating resistors built-in correctly at the beginning and end of the BMS bus and switched on?
no
Install the terminating resistors properly or switch them on (use the DIP switch at MK2430 "Term" on/off)
yes
MK2430-11 only: Do the digital inputs have the appropriate voltage?
no
Make corrections
yes
MK2430-11 only: Are the digital inputs connected properly?
no
Make corrections
yes
Are the other devices connected correctly?
no
Make corrections
yes
Are the addresses on all devices correctly set according to the plan?
no
Make corrections, possibly you first have to switch supply voltage on.
yes
Are the rules specified in the "BMS bus" instruction leaflet adhered to ?
no
Make corrections
yes
Are all devices in the system up to date?
no
Update the respective device.
yes
Switch voltage supply on. Then proceed with "tests after switching on"."

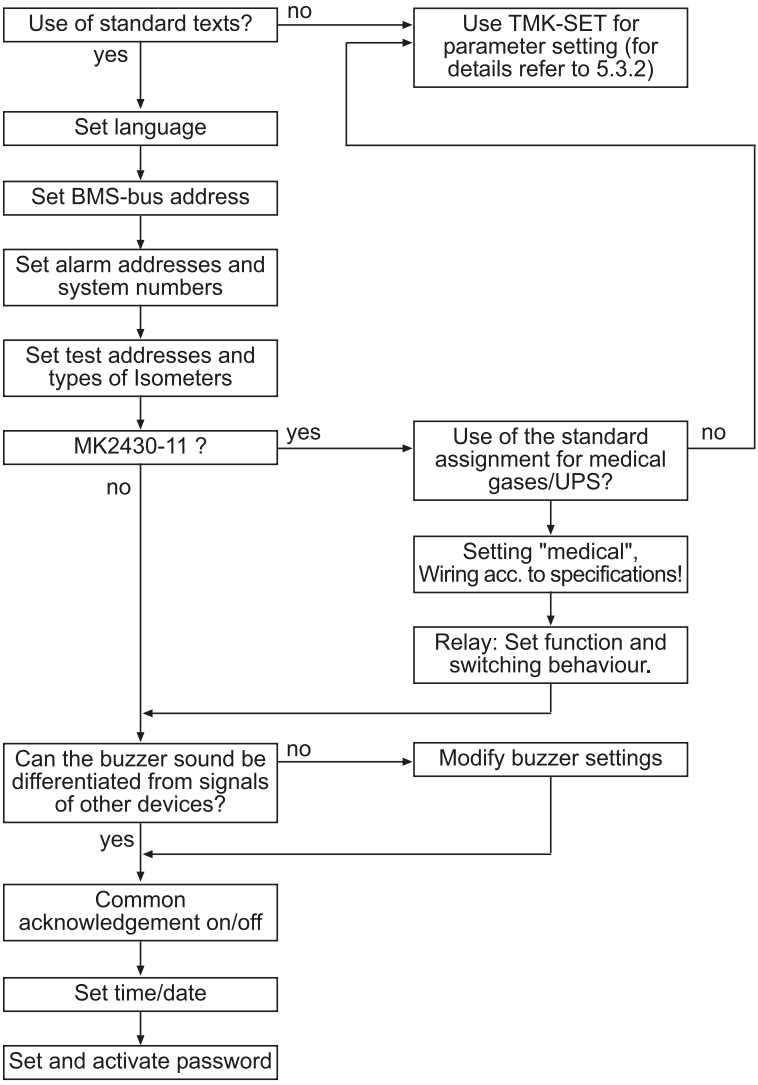
5.2 Tests after switching on


Check the supply voltage of MK2430 (terminals U2, V2). Voltage OK?
no
Make corrections. If required, connect another or different power supply unit for MK2430 supply.
yes
Fix the MK2430 to the enclosure.
Does anything appear on the MK2430 display?
no
Did the supply voltage or the MK2430 fail?- Remove the fault.
yes
Does the MK2430 display a fault message?
yes
Make a note of the message. Adapt the indicating device to the system or remove the fault.
no
Connect a PC utilizing TMK-SET software. Activate the TMK-SET function "Bus scanning". Are addresses and software versions of connected devices OK?
no
Make corrections
yes
Set MK2430 parameters

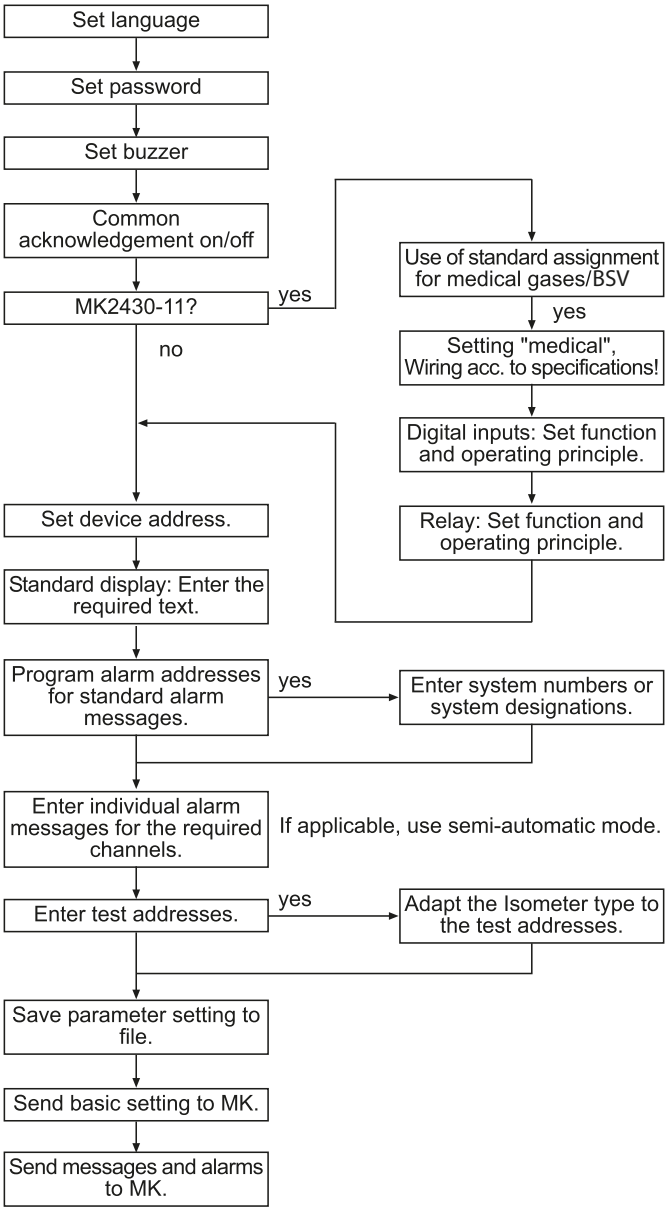
5.3 Make parameter settings

All settings can be carried out via the TMK-SET software. Alternatively, some settings can be carried out via the MK2430 menu (see diagrams).

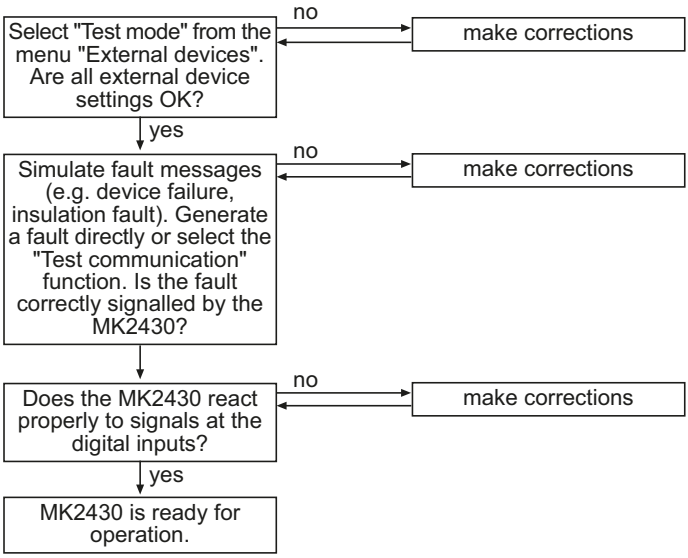
5.3.1 Settings at the MK2430



5.3.2 Settings in the software TMK-SET


Set language
Set password
Set buzzer
Common acknowledgement on/off
MK2430-11?
yes
no
Use of standard assignment for medical gases/BSV
yes
Setting "medical", Wiring acc. to specifications!
Digital inputs: Set function and operating principle.
Relay: Set function and operating principle.
Set device address.
Standard display: Enter the required text.
Program alarm addresses for standard alarm messages.
yes
Enter system numbers or system designations.
Enter individual alarm messages for the required channels.
If applicable, use semi-automatic mode.
Enter test addresses.
yes
Adapt the Isometer type to the test addresses.
Save parameter setting to file.
Send basic setting to MK.
Send messages and alarms to MK.

5.3.3 Tests after parameter setting


Select "Test mode" from the menu "External devices". Are all external device settings OK?
no
make corrections
yes
Simulate fault messages (e.g. device failure, insulation fault). Generate a fault directly or select the "Test communication" function. Is the fault correctly signalled by the MK2430?
no
make corrections
Does the MK2430 react properly to signals at the digital inputs?
no
make corrections
yes
MK2430 is ready for operation.

5.4 Periodic verification and service

5.4.1 Periodic verification

The following periodic verification must be performed on electrical installations in compliance with the local or national regulations that apply. We recommend for your Bender products:

Test	To be performed by	Interval
Functional test of the IT system monitoring (insulation, load current, transformer temperature and connection monitoring) by pressing the "TEST" button on the alarm indicator and test combination or on the alarm indicator and operator panel	Medical personnel	Once every working day
Functional test of the changeover module*: Functional test of the automatic changeover modules. Please observe the information in the chapter "Testing the changeover module" (operating manual of the changeover module)!	Electrically skilled person	Every six months
Functional test of the IT system monitoring (insulation, load current, transformer temperature and connection monitoring) on the insulation monitoring device	Electrically skilled person	Every six months
Checking the setting values and changeover periods	Electrically skilled person	Every 12 months
Test the transfer switching device, the IT system monitoring, and the connection to the SCADA system (Supervisory Control and Data Acquisition) (if applicable) and the interaction between the components on the system. The test encompasses the following: - Inspection: Marking, display elements, mechanical components, wiring, parameterisation, connection of third-party systems, evaluation of fault memory - Measurement: Internal/external supply voltages/potentials, bus voltage, bus protocol, bus scan - Testing: Device function, device communication - Documentation: Test results, recommendations for eliminating defects	Bender Service	Every 24 months

* *This test must only be performed by an electrically skilled person who has been appointed to do so in agreement with the medical locations concerned.*

Before carrying out the tests, please refer to the instructions relating to the functional tests in the check list. If no national directives apply, you should perform the tests recommended by IEC 60364-7-710 :2002-11, section 710.62 and DIN VDE 0100-710 (VDE 0100 Part 710): 2002-11, section 710.62.

5.4.2 Service and support

Bender would be delighted to provide service for commissioning, troubleshooting and periodic verification:

First Level Support

Technical support by phone or e-mail for all Bender products

- All questions about customer applications
- Commissioning
- Troubleshooting

Tel.:	+49 6401 807-760*
Fax:	+49 6401 807-259
only available in Germany:	0700BenderHelp (Tel. and Fax)
E-mail:	support@bender-service.com

Repair Service

Repair, calibration, update and replacement service for all Bender products

- Repair, calibration, testing and analysing Bender products
- Hardware and software update for Bender devices
- Delivery of replacement devices for faulty or incorrectly delivered Bender devices
- Extended warranty for Bender devices with in-house repair service resp. replacement devices at no extra cost

Tel.:	+49 6401 807-780** (technical issues)
	+49 6401 807-784**, -785** (commercial matters)
Fax:	+49 6401 807-789
E-mail:	repair@bender-service.com

Please send the devices for repair to the following address:
Bender GmbH, Repair Service, Londorfer Strasse 65, 35305 Gruenberg, Germany

Field Service
On-site service for all Bender products

- Commissioning, parameter setting, maintenance, trouble shooting for Bender products
- Analysis of the electrical installation in the building (power quality test, EMC test, thermography)
- Practical training courses for customers

Tel.:	+49 6401 807-752**, -762 **(technical issues)
	+49 6401 807-753** (commercial matters)
Fax:	+49 6401 807-759
E-mail:	fieldservice@bender-service.com

*Available from 7.00 a.m. to 8.00 p.m.on 365 days of the year (CET/UTC+1)
**Mo-Thu 7.00 a.m. - 8.00 p.m., Fr 7.00 a.m. - 13.00 p.m

Internet: www.bender-de.com

5.4.3 Maintenance

MK2430 does not contain any parts that require maintenance. Despite this, the intervals specified for periodic verification should be adhered to.

6. Troubleshooting

6.1 Error messages of MK2430

The following errors are recognised by the MK2430 and indicated on the display. In addition, the buzzer emits a beep code every 10 seconds corresponding to the number of the error.
MK2430..-11 only: "Settings menu 11: Relay": if the function "device error" has been set, also the alarm relay switches.

No.	Displays	Description	Actions
1	DISPLAY ERROR	Display defective	Replace the MK2430*
2	I2C-BUS ERROR(X)	Fault I^2C bus	switch off the device for 10 minutes, switch on again; if unsuccessful: Replace the MK2430*
3	RTC ERROR	Clock chip defective	Replace the MK2430*
4	FLASH ERROR	Assignment chip defective	Replace memory chip D15 (socketed) or replace MK2430*
5	Address ERROR (XXX)	Address of the MK2430 on the internal BNS bus is already in use (XXX = current address)	Change the MK2430 address in the menu
6	Overflow ERROR (03)	More than 80 alarm messages are present at the same time	Reduce number of messages
	Overflow ERROR (05)	More than 200 device failure messages are present	Reduce number of messages
	Overflow ERROR (07)	More than 99 text messages are present	Reduce number of messages
	Overflow ERROR (08)	Automatic correction of the history memory is carried out because of voltage interruption.	none
	Overflow ERROR (11)	Stack Error	Make a note of the error code and contact Bender Service.
7	Checksum ERROR	Program memory defective	Replace the MK2430*

* Please make a note of the cause of error, the error number and if applicable the error code. This information facilitates the diagnosis and repair of the equipment.
X Error code

6.2 Malfunctions

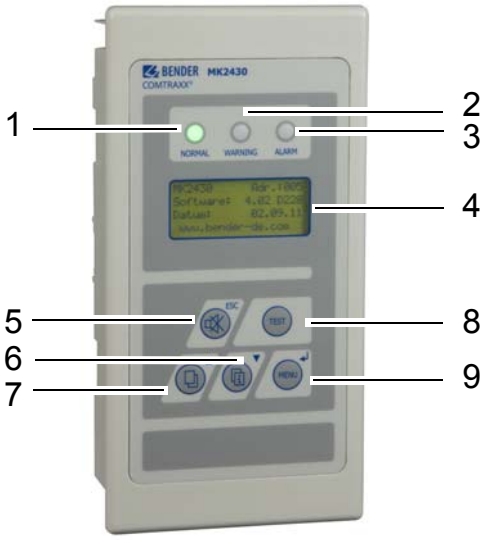
List of possible errors and proposals for the correction of the faults. This error list does not claim to be exhaustive.
Possible error codes occurring during a test are listed in the chapter "Test function" on page 49f.

Errors	Possible cause / Actions
MK2430 display blank	Check AC/DC 24 V power supply.
Display is lit up but no characters on the screen.	Replace the MK2430
Function buttons not working.	Replace the MK2430
LEDs not working	Replace the MK2430
Character matrix visible on display, but firmware does not start.	Processor does not start; replace MK2430
Time of day gets lost in case of short-term voltage failure.	Replace the MK2430
Error during transfer of the assignments or basic settings via the USB interface.	MK2430 address not properly set (menu); MK2430 address does not match setting of TMK-SET configuration software; USB cable defective; wrong serial interface (com port) set in TMK-SET.
Error on internal BMS bus.	Device addresses not properly set on the internal bus; interface cables A/B mixed up; network incorrectly terminated or not at all; incorrect parameter setting with TMK-SET.
Error relating function of digital inputs.	Digital inputs not correctly set with TMK-SET. Defective connection (does not match pre-assignment). Incorrect setting "neutral/medical".

7. Operation

This chapter can also be used as a quick reference guide by medical operating personnel.

7.1 Operator control and display elements



LED and LCD

1	LED "NORMAL": Power On indicator, green (only lights up if no warnings or alarms are pending)
2	LED "WARNING": Warnings, yellow
3	LED "ALARM": Alarm messages, red
4	LCD: Display of operating status and alarm messages as well as menu functions

The buttons have the following functions:

No.	In operating mode	In menu mode
5	"Mute" button Set buzzer to mute following alarm / acknowledge alarm	"ESC" button Exit function (without saving) resp. go up one menu level. When the buzzer is sounding, you can press ESC to set it to mute.
6	Button " " (additional text) Switch between display text and possible additional text for message	Down button "▼" Down in menu
7	Scroll button " " Scroll through the warnings and alarms if there is more than one message pending	Up button "▲" Up in the menu
8	"TEST" button Press and release: LED test Press and hold down: Initiate testing of assigned devices (insulation monitoring devices, LIM, GFCI)	No function
9	"MENU" button Starts menu mode in order to make MK2430 settings; for display and control functions	"ENTER" button "↵" Confirm menu option selection

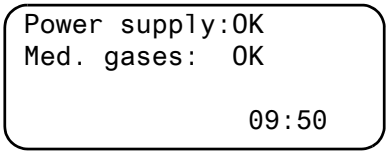
7.2 Quick reference guide

The following images have been provided by way of example only.

7.2.1 Display in error-free operation

There are no warnings or alarms pending.

- The green "Normal" LED is lit.
- The programmed standard information appears on the LC display.
- A maximum of 3 measuring values can be indicated in the lines 1…3.

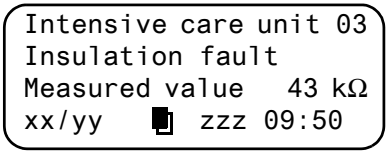


– Line 1…3: user-definable **s**tandard display text
– Line 4 status bar, indicates the time of day (can be switched off)

7.2.2 Display in fault condition

A warning or an alarm message is pending.

- Depending on the type of fault, either the yellow LED "Warning" or the red LED "Alarm" will light up. The green LED "Normal" goes out.
- The buzzer sounds at the same time. If the cause of the message cannot be remedied immediately, the buzzer can be deactivated by pressing "Mute" (5).
- Information about the message appears on the LC display.



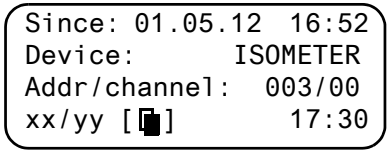
– Line 1: Standard display: "System"
User-defined text here: "Intensive care unit 03"
– Line 2…3: message text, may contain measured value

– Line 4 Status line
  xx = Consecutive number of message displayed
  yy = Number of pending messages
  = Message text page, in this case page 1
  zzz = Insulation fault location or test in progress (see table)
  09:50 = Time of day (example)

Possible displays during insulation fault location or testing:

zzz	Meaning
EDSa	EDS insulation fault location in progress (automatic)
EDSp	Continuous EDS insulation fault location in progress
EDSs	Single-pass EDS fault location in progress
EDS	EDS insulation fault location was deactivated, the current measuring sequence is still running
TEST	Test in progress. "TEST" flashes if the message on the display is associated with the test.
noMA	No MASTER
MAST	Device is currently "substitute master".

- Press the " " button (6) for detailed information.

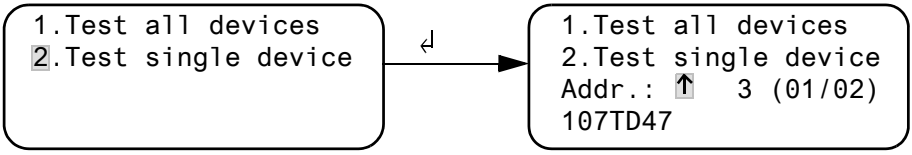


– Line 1: date and time the message occurred
– Line 2 device triggering the message
– Line 3: Address of the device sending the message
– Line 4 xx = consecutive number of the message displayed
  yy = number of pending messages
  = message text page, in this case page 2
  17:30 = time of day (example)

The display may deviate accordingly in case of user-defined messages.
If messages are pending and one of the arrow buttons is pressed, the current message will appear on the display. If no further button is pressed, this indication will be displayed for 15 seconds.

7.2.3 Test function

Press and hold down the "TEST" button for at least one second to check the function of the assigned insulation monitoring devices (e.g. 107TD47, IRDH…), LIM (Line Isolation Monitors) and GFCI (Ground Fault Circuit interrupters). A message is output only on the MK2430 on which the test button "TEST" was pressed.



1. Test all devices — Test of all devices set in the "Test addresses" menu.
2. Test single device — Select a device using the arrow buttons and press "↵" button.

During the test, the text "TEST" will appear in the status bar. "TEST" flashes if the message on the display is associated with the test.

The assigned devices are tested one after the other. The MK2430 automatically evaluates the messages that appear. Once the process is complete, either a common message indicating that the test has been successful or an error message is output.

If more than one device has been tested, a separate error code will be displayed for each device failing the test.

The following error codes are displayed in the event of an ISOMETER® failing the test:

Error code	Meaning for the 107TD47 (hospital ISOMETER®)	Meaning for the IRDH… (Industrial ISOMETER®)	Note
0	No messages received from ISOMETER® despite it confirming the test command.	No messages received from ISOMETER® despite it confirming the test command.	
1	Only insulation fault message received	Only insulation fault message received from channel 1	Channel 1
2	Only overload fault message received	Only insulation fault message received from channel 2	Channel 2
3	Only insulation fault message and overload message received		Channel 1 and 2
4	Only overtemperature message received		Channel 3
5	Only insulation fault message and overtemperature message received		Channel 1 and 3
6	Only overload message and overtemperature message received		Channel 2 and 3
14	Unable to send test command as request not received (slave).	Unable to send test command as request not received (slave).	Slave only
15	ISOMETER® did not confirm the test (no response).	ISOMETER® did not confirm the test (no response).	

Notes about error codes

- For MK2430 operating as "slaves" on the BMS bus, a time-out of 50 seconds is applicable for error codes 0 and 14.
- Error code 14 is displayed if the test has been requested on a slave but the test command cannot be sent because the MK2430 was not scanned. This can be the case if the address gap upstream of the MK2430 is so large that the master does not scan the MK2430 (refer to "BMS bus" operating manual). This error code is less of an indicator that an ISOMETER® is faulty and much more of an indicator of a fault on the BMS bus system.

8. Menu mode: Operation and setting

8.1 Switching on and calling up the main menu

When the MK2430 is connected to the power supply, the following information appears on the display for approx. 3 seconds. It indicates the address and firmware version of the device. This information can also be accessed in the "Info" menu.

```
MK2430-11   Addr.:001
Software 4.02   D228
Date:       02.05.12
  www.bender-de.com
```

If the MK2430 was not supplied with voltage for several days, a longer time may be required for start-up (approx. 30 seconds). In this case, time and date have to be entered again.

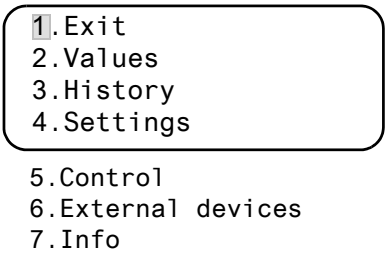
If there are no messages pending, the standard display will appear after the start.

```
      SYSTEM READY!

                09:50
```

The standard display and the message texts can be modified in the TMK-SET software.

Press the "Menu" button for approximately two seconds to open the main menu.

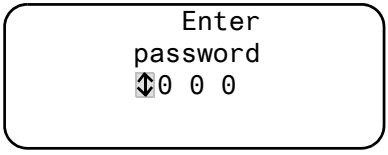


The following buttons are used on the main menu:

ESC	Exit function or go up one menu level.
▲, ▼	Select menu items
↵	Confirm selected menu item (Enter)

If no buttons are pressed in a menu for a period of more than five minutes, menu mode is exited automatically (exception: "test communication" in the "Control" menu and "position mode" in the "External devices" menu).

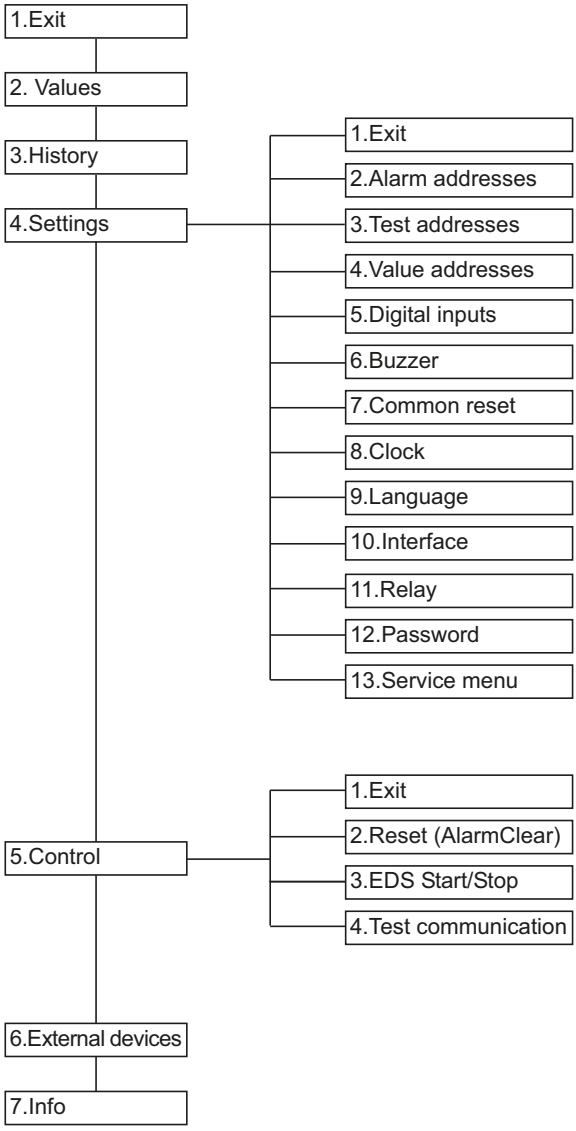
Some menus are password-protected. Password protection is only effective if the password has been enabled (switched on).
When an attempt is made to open one of these menus, the password entry screen appears automatically:



Once a valid password has been entered, full access will be granted to all menus (except the Service menu) until menu mode is exited.

8.2 Menu overview diagram

The following diagram will help you to familiarise yourself with the menu:



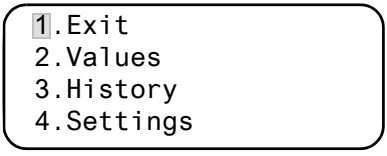
8.3 Main menu functions

Menu item	Mode	Page
1. Back	Exit menu mode	
2. Measured values	No function	
3. History	Displays history with information about messages, acknowledgements and associated times.	55
4. Settings	Various settings for this MK2430	57
5.Control	This menu offers various options for controlling the overall system.	68
6. External devices	Settings on the connected evaluators (e.g. EDS4xx and RCMS4xx).	70
7. Info	Information about the device type, the firmware version and the last time the assignments were transmitted.	71

8.4 The main menu

8.4.1 Back

Exits menu mode.



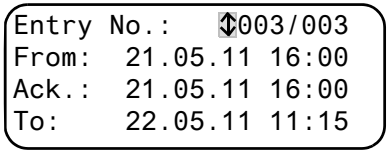
8.4.2 Menu 2: Measured values

This menu has no function.

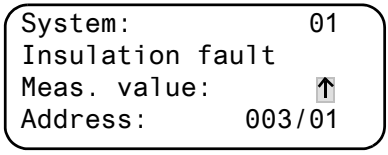
8.4.3 Menu 3: History

The MK2430 can store up to 250 messages in the history memory (ring buffer). Once the MK2430 reaches the limit of 250 messages, message 251 will overwrite message 1. The "History" menu provides information about messages, acknowledgements and associated times. It also indicates whether an alarm is still pending or when it was acknowledged / set to mute with the "Mute" button. The complete content of the history memory with additional texts and address of the device sending the message can be displayed on a PC and printed out using the TMK-HISTORY software version V3 or higher. All interfaces of MK2430 can be used for connection.

1. Use the arrow buttons to select the entry you require.
   The most recent entry appears first on the display. Older messages can be selected using the arrow buttons.



2. Press "↵" to call up the message text for the selected entry. The path the message took to reach MK2430 appears in the last line. In this case an insulation fault was received via the internal BMS bus from address 003, channel 01. The table on the following page contains information about other possible displays.



3. As shown in the example above, the min. and max. values display can be called up by pressing "▲".
4. Press "↵" again to go back to the entry selection screen.

Repeat this process for all required messages. Then press "ESC" to exit the menu.

Possible displays in the last line of the history memory message text display:

Text	Meaning
Address: aaa/kk	Address of the device triggering the message (aaa= device address, kk= channel no. of the message)
Digital Inp Nr.: kk	Number (kk) of digital input on this MK which triggered the message.
TESTex	Note that the current history entry was created as the result of a test initiated on this MK.
TESTin	Note that the current history entry was created as the result of a test and was triggered on the device assigned to it (insulation monitoring device, LIM, GFCI)

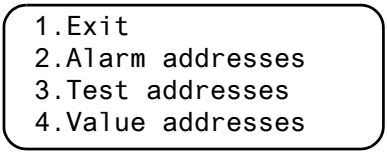
8.4.4 Menu 4: Settings

The following menu options are available for configuring the MK2430:

Menu item	Mode	Page
1. Back	Exit "Settings" menu; go up one menu level	
2. Alarm addresses	Setting of bus addresses for devices whose alarm messages are to be displayed on this MK2430	58
3. Test addresses	Setting of bus addresses for devices which are to carry out a test when the "TEST" button is pressed.	59
4. Measured value addresses	No function	60
5. Digital inputs	MK2430-11 only: Setting of the operational characteristics of digital inputs.	60
6. Buzzer	Setting of the frequency and repetition rate of buzzer signal.	62
7. Common acknowledgement	Setting whether this MK2430 should respond to a common acknowledgement initiated via the reset button on an external device	62
8. Clock	Setting of the date and time on the real-time clock on this MK2430. At the same time this setting is sent via BMS bus and all other devices are synchronised. The device with address 1 (MK2430 or alarm indicator and operator panel) synchronises all other devices every hour	63
9. Language	Selection of operating language for the MK2430 (German or English)	64
10. Interface	Setting of the device address and baud rate for this MK2430	65
11. Relay	Mode of operation and function of the common alarm relay (alarm relay) on the MK2430-11	66
12. Password	Change password, activate/deactivate password.	67
13. Service menu	Reserved for settings to be made by authorised Bender Service personnel. Call up information about the device status, make settings for specific operating conditions and run firmware update.	67

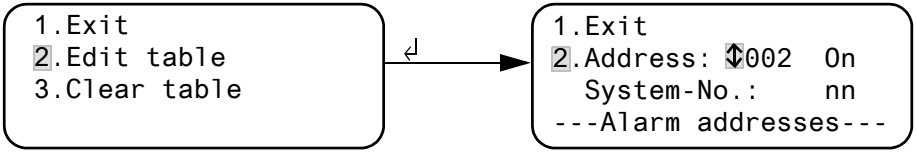
8.4.4.1 Back

Exit menu mode.



8.4.4.2 Settings menu 2: Alarm addresses

Setting of bus addresses for devices whose alarm messages are to be displayed as standard messages on this MK2430.
The address of this MK2430 is automatically set to "On". All other alarm addresses are set to: "Off".
Set the addresses of devices whose messages are to be displayed on this MK2430 to "On". Only these addresses are monitored for presence on the BMS bus. If a device cannot be found on the bus, an alarm message will appear.
The text of individual messages can be modified using the TMK-SET software.
If a number of systems or areas (e.g. several operating theatres) are connected to the MK2430, the system numbers 1…4 can be assigned to them.



1. Exit — Back to the main menu.
2. Edit table — Use the arrow buttons to select the address on the internal BMS bus and confirm your selection by pressing "↵".
   Use the arrow buttons to select "On" and activate this address ("Off" = deactivate). Press "↵" to accept the entry.
   Use the arrow buttons to select System no.: "nn" and confirm your selection by pressing "↵".
   Repeat the procedure to activate more alarm addresses.
3. Clear table — Deactivate all addresses (off). "Clear table" is only possible when there are no test addresses activated (see setting menu 3 "Test addresses".

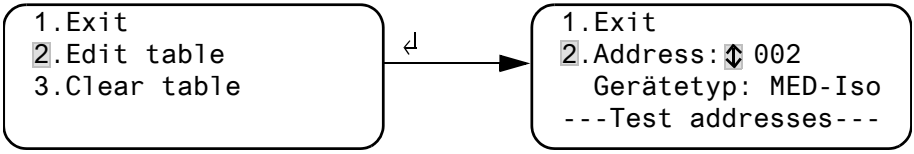
Possible system number settings:

nn	Meaning
00	No text appears in line 1 of the alarm message.
01…04	Texts "System 01" to "System 04" are displayed.
T	Programmed text is displayed.

8.4.4.3 Settings menu 3: Test addresses

Setting of bus addresses for insulation monitoring devices (e.g. 107TD47, IRDH…), transfer switching devices with monitoring functions (ATICS®), LIM (Line Isolation Monitors) and GFCI (Ground Fault Circuit interrupters) which are to carry out a test when the "TEST" button is pressed. The setting can only be made for devices which have also been activated in the "Alarm addresses" menu and/or programmed for individual alarm texts. Individual alarm texts are a minimum requirement for:

- Channel 1…3 (setting "107TD47")
- Channel 1 (setting "IRDHxxx")



1. Exit — Back to the main menu.
2. Edit table — Use the arrow buttons to select the internal BMS bus address and confirm your selection by pressing "↵ ".
   Use the arrow buttons to select the device type:
   - LIM — Line Isolation Monitors
   - GFCI — Ground Fault Circuit interrupter
   - IND-Iso — Industrial Insulation monitoring device
   - MED-Iso — Medical insulation monitoring device
   - Off — Address deactivated

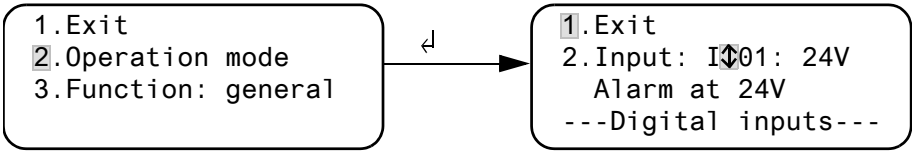
   Press "↵" to accept the entry.
   Repeat the procedure to activate more addresses.
3. Clear table — Deactivate all addresses (off).

8.4.4.4 Settings menu 4: Value addresses

Currently has no function.

8.4.4.5 Settings menu 5: Digital inputs (MK2430-11 only)

Setting of the operational characteristics of digital inputs IN01…IN12. The following setting can be made individually for each input: "24V" (high) or "0V" (low).
If "24V" is set for an input, an alarm message will be output if 24 Volt exists there. If "0V" is set for an input, an alarm message will be output if 0 V exists there. It is for this reason that you should always set unused digital inputs to "24V".



1. Exit	Back to the main menu.
2. Operation mode	Use the arrow buttons to select the digital input and confirm your selection by pressing "↵". Use the arrow buttons to select "24 V" or "0 V". Press "↵" to accept the entry. Repeat the procedure to set more digital inputs.
3. . Function	Set the message text category "neutral" or "medical", see "neutral and specific alarm messages" on page 61

Digital input alarm texts

A neutral or specific alarm message can be assigned to all digital inputs. A neutral alarm message indicates the alarm, the channel and the address of the device triggering the alarm. In comparison, specific alarm messages (medical) signal non-modifiable pre-programmed alarms, e.g. "oxygen".
Assign the inputs in accordance with table "neutral and specific alarm messages" on page 61.

Other messages can be assigned to individual or all digital inputs with the TMK-SET PC software.
If freely programmable alarm messages need to be displayed on a different MK2430 or an alarm indicator and operator panel, the same alarm messages must have been programmed in the displaying device.
The alarm messages in the following table are sent to other MK… or alarm indicator and operator panels via BMS bus and displayed there in plain text format.

Specific alarm messages

These messages contain instructions for medical gases and UPS systems.

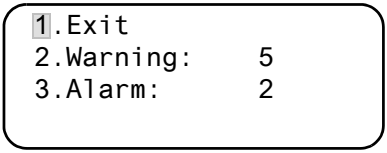
Alarm messages for medical gases are signalled by the red "ALARM" LED and the buzzer sounding. The buzzer can be set to mute (acknowledged). It will sound again after 15 minutes by way of reminder.
Non-standard settings can only be made using the TMK-SET software.

neutral and specific alarm messages

Inputs	Neutral alarm messages "Function: Neutral"	Specific alarm messages "Function: Medical"
IN1	Alarm: Address/channel XXX/01	Alarm: Oxygen
IN2	Alarm: Address/channel XXX/02	Alarm: Vacuum
IN3	Alarm: Address/channel XXX/03	Alarm: Nitrous oxide
IN4	Alarm: Address/channel XXX/04	Alarm: Compressed air 5 bar
IN5	Alarm: Address/channel XXX/05	Alarm: Compressed air 8 bar
IN6	Alarm: Address/channel XXX/06	Alarm: Nitrogen
IN7	Alarm: Address/channel XXX/07	Alarm: CO2
IN8	Alarm: Address/channel XXX/08	Alarm: BSV battery operation
IN9	Alarm: Address/channel XXX/09	Alarm: BSV overload
IN10	Alarm: Address/channel XXX/10	Alarm: BSV converter failure
IN11	Alarm: Address/channel XXX/11	Alarm: BSV fault
IN12	Alarm: Address/channel XXX/12	Alarm: BSV test run

8.4.4.6 Settings menu 6: Buzzer

The buzzer will sound in the event of a warning or an alarm message. Setting the frequency and repetition rate to distinguish the two buzzer tones.

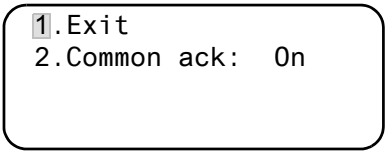


1. Exit Back to the main menu.
2. Warning
3. Alarm Various standard signals can be selected for "Warning" and "Alarm". An individual buzzer sound can be selected via TMK-SET.

During setting the selected buzzer signal will sound and the LED will light up or flash.

8.4.4.7 Settings menu 7: Common acknowledgement

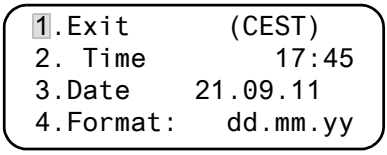
Setting indicating whether this MK2430 should respond to the acknowledgement of the buzzer/buzzer mute initiated by pressing Buzzer mute button"🔇" on another MK… or TM… operator panel ("On") or "Off".
Activating the common acknowledgement function can for example make it possible to acknowledge (mute) an alarm (buzzer tone) on an MK… or a TM… located in a neighbouring building from an MK2430 in a central location.
The alarm message itself will remain visible on the display until its cause has been rectified.



1. Exit Back to the main menu.
2. Common ack.: Setting of the common acknowledgement for the internal bus.
   - On Buzzer can be acknowledged (muted) externally
   - Off Buzzer cannot be acknowledged (muted) externally

8.4.4.8 Settings menu 8: Clock

This menu is used to set the time of day, date and date format display. These settings remain stored for approx. 5 days following a power supply failure.
The clock switches automatically to central European summer time (CEST) and winter time (CET). Reset the clock if the time of day no longer matches your local time following automatic switchover.
Automatic switchover can be deactivated (see 5. "Daylight sav.").

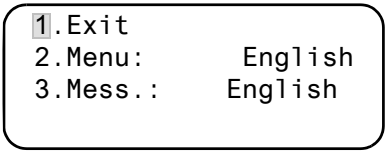


1. Exit — Back to the main menu
2. Time — Set time of day (hours and minutes)
3. Date — Set date (according to the format indicated in line 4)
4. Format — Select German (dd. mm. yy) or American (mm/ dd/yy)
5. Daylight sav. — Setting for automatic switchover to Central European Summer Time:
   Auto — automatic switchover
   Off — no switchover

You can set the system time of day and date on any MK2430 or alarm indicator and operator panel. The settings are transferred via the BMS bus to the master device (address 1), which transfers the settings to all other MK2430 or alarm indicator and operator panels.

8.4.4.9 Settings menu 9: Language

Selection of the language for using the menus and displaying messages (alarm and operational status messages) on the MK2430. Changes take effect immediately.



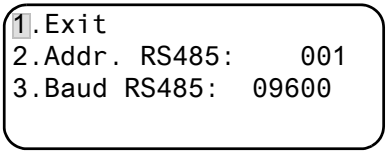
1. Exit — Back to the main menu.
2. Menu — Set the operating language for the menu: English or Deutsch
3. Message — Set the display language for the messages. You may select:

English	English	French	Italian
Spanish	Portuguese	Portuguese (Brazilian)	Dutch
Norwegian	Swedish	Finnish	Danish
Polish	Hungarian	Czech	Slovenian
Croatian	Serbian	Turkish	Indonesian

The language setting activates the language-specific special characters. However, user-defined alarm texts remain unchanged. Therefore do not program or transfer the individual alarm texts until the language settings are configured.

8.4.4.10 Settings menu 10: Interface

Setting of the device address of this MK2430 and indication of the transmission speed (baud rate) for the connection to the internal BMS bus (RS-485).

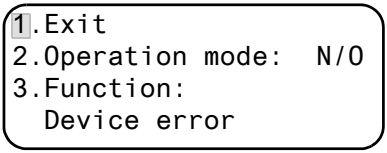


1. Exit — Back to the main menu.
2. Addr. — Device address setting of this MK2430.
   Any address can be selected within the range of 1…150, the addresses 100 to 110 are intended for special applications (e.g. PC, OPC) and cannot be used for devices.
   Factory setting is address 001 (master).
3. Baud — The fixed pre-assigned baud rate is 9600 Bit/s

Change the corresponding device address if a number of MK2430 are connected to one internal BMS bus. One MK2430 must have the address 1 (master). All other MK2430 are addressed in consecutive order: 2,3,4… There should be no gaps between addresses to ensure smooth system functioning (also refer to the "BMS bus operating manual"). Data exchange will only work between devices with the same baud rate.

8.4.4.11 Settings menu 11: Relay

Set the mode of operation and function of the optional alarm relay on the alarm indicator and test combination. This menu only exists on the MK2430…-11.

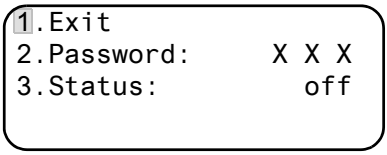


1. Exit Back to the main menu.
2. Relay mode Set the mode of operation:
   N/O N/O operation
   N/C N/C operation
3. Mode Alarm relay switches in the event of:

Setting	Description
Device error	Relay switches in case of an internal fault on the MK2430-11.
Common alarm	Relay switches in case of any warning or alarm message.
Device failure	Relay switches as soon as the MK2430 recognises a device failure.
ISOMETER test	Relay switches for approx. 3 seconds once a test is started via the "TEST“ button at the assigned devices (insulation monitoring devices, LIM, GFCI).
Buzzer function	The relay switches as soon as the buzzer sounds. Also other signalling devices can be installed to indicate pending messages on the MK2430.
Programmable	Programming via TMK-SET -> individual alarms or operating messages

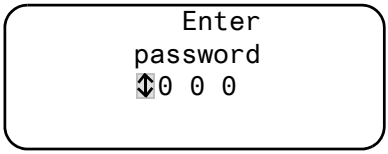
8.4.4.12 Settings menu 12: Password

Change, activate/deactivate password.



1. Exit	Back to the main menu.
2. Password	Change password. Factory setting: 807
3. Status:	Activate or deactivate password protection.

Some menus are password-protected. Password protection is only effective if the password has been enabled (switched on).
When an attempt is made to open a window, the entry screen for entering the password appears automatically:



Once a valid password has been entered, full access will be granted to all menus (except the Service menu) until menu mode is exited.

8.4.4.13 Settings menu 13: Service menu

The Service menu is reserved for settings made by authorised Bender Service personnel. It can only be accessed subject to the entry of a master password.

In the Service menu, information about the device status can be called up and settings for specific operating conditions can be made.

8.4.5 Menu 5: Control

This menu offers various options for controlling individual devices or the overall system:

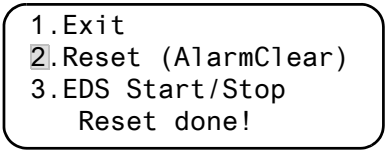
Menu item	Mode	Page
1. Back	Exit "Control" menu; go up one menu level	
2. Reset (AlarmClear)	Resetting all fault messages pending on the BMS bus	68
3. EDS start/stop	Manual starting/stopping of test procedures on EDS system	69
4. Test Communication	Testing of communication via the BMS bus (MK2430-11 only).	69

8.4.5.1 Back

Exit menu mode.

8.4.5.2 Control menu 2: Reset (AlarmClear)

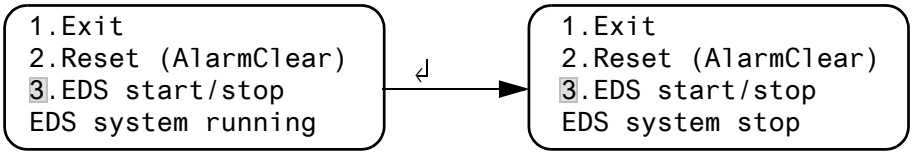
Press "↵ " to reset all pending fault messages on the BMS bus. "Reset done!" will then appear in the last line displayed.



This reset command is sent via the BMS bus. Note that some devices (e.g. PRC470) do not react to this reset.

8.4.5.3 Control menu 3: EDS start/stop

Press "↵" to start and stop the test procedure manually on the EDS system. This function can only be activated for the master. The current status appears in the last line.



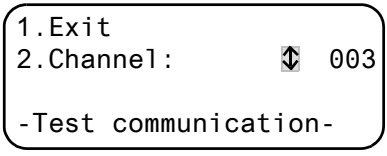
EDS system running	Once started, EDS4xx-12 and PGH47x run continuously. If you exit the menu, the standard display "EDSp" will appear in the last line in order to indicate continuous running*.
EDS system stop	Stops the continuous pass of EDS4xx-12 and PGH47x. If you exit the menu, the standard display "EDS" will appear in the last line until the current test pass finishes.

*Other abbreviations that might appear in the last line of the display:

EDSa	Automatic mode: Insulation fault location has been started by e.g. ISOMETER®, ATICS® or isoMED427P on PGH47x .
EDSs	Single mode: A single pass has been started by IN2 on PGH471.

8.4.5.4 Control menu 4: Test communication (MK2430-11 only)

Testing communication via the BMS bus. For this purpose, an error message is simulated on a digital input. This fault message is sent to evaluator devices (e.g. alarm indicator and test combinations MK2430, SMO…etc.) via BMS bus. Check that these devices are responding to the fault message as requested.

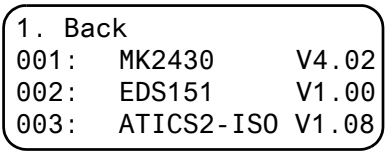


Channel 003	Setting of the channel whose message is to be activated.

8.4.6 Menu 6: External devices

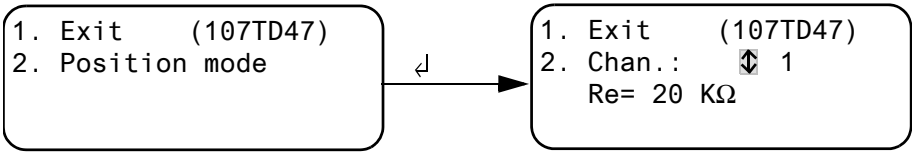
This menu is used to set and control external devices. Functions include for example displaying information about connected devices (address, software version, device type) or continuous displaying a channel on a connected evaluator.

After calling the menu, select the address of the external device to be displayed (e.g. EDS4xx-12 or RCMS4xx-12).

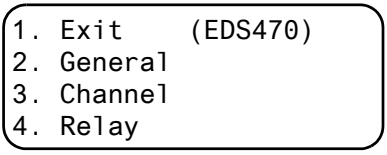


Address, type and version of the connected device are indicated. When no device is detected under this address, the character "?" appears. Use the arrow buttons to select the address of the external device and confirm your selection with the "↵" button.

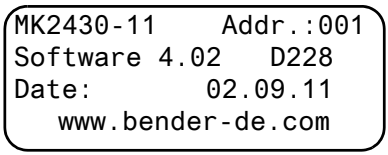
If the device has been recognised, the MK2430 will read the current settings of the connected device. The device type is displayed in the first line of the display.
Use the Up/Down buttons to select the appropriate function or device setting. Confirm with the "↵" button. Example:



Numerous setting options are available in the EDS or RCMS menu. These are described in more detail in the operating manuals for the corresponding systems.



8.4.7 Menu 7: Info



Information about the device type, the firmware version and the last time the assignments were transmitted. Assignments are settings carried out via the PC software TMK-SET:

- Enter standard texts
- Assign texts and functions to alarm messages and digital inputs of the MK2430
- Set parameters

Select:

ESC	Exit menu mode
▲	Show date of last assignment transmission. Assignments are settings carried out via PC software (e.g. TMK-SET): - Enter standard texts - Assign texts and functions to the alarm messages and digital inputs of the MK2430 - Set parameters
▼	Show version of standard texts and number of - activated alarm addresses - activated test addresses - individually programmed messages
↵	Go back to the main menu

8.5 Overview of setting options

Die MK2430 supports various setting modes. The table below shows where the individual parameters can be set.

Parameter				Set in			
Name	**Range**	**Factory setting**	**User setting**	**MK2430 menu**	**MK2430 Service menu**	**TMK-SET Parameter menu**	**Note**
History entries	--	--	--	--	clear	clear	Data records Clear history
Power-down watchdog	--	--	--	--	clear	clear	Reset counter
Time-out int.	42…200 ms	60 ms		M13	x	x	Change only for test purposes!
ALMI idle time	1…2 s	1 s		M13	x	x	Time between two ALMI queries on the internal BMS
Backlight	autom./cont.	autom.		M13	x	x	
S/W time	autom./OFF	autom.		M8	--	x	Automat. summer/winter time
Buzzer	ON/OFF for 1...9 hrs	ON	--	M13	x	--	e.g. for commissioning
Password prompt	Y/N	Y		M12	--	x	Activate password prompt
Password	000...999	807		M12	--	x	Change password
Language (for menu only)	English/ German	German		M9	--	x	
Language (for message only)	20 languages	German		M9	--	x	
Time/message	3...8 s	5 s		M13	x	x	Message interval
Buzzer settings	Duration/ interval 1…5 frequency	2		M6	--	x	
Common acknowledge int.	Y/N	Y		M7	--	x	Response to "buzzer OFF" via BMS bus
Time of day/date				M8		x	
RS-485 settings address	1…150	1		M7	--	x	Int. BMS bus address
Time display	Y/N	Y		M13	x	x	Time in the standard display
Display ATICS maintenance messages	Y/N	N		M13	x	x	

9. Technical data

9.1 Technical data

Insulation coordination acc. to IEC 60664-1

Rated insulation voltage ..... AC 250 V
Rated impulse voltage/pollution degree 4 kV/3

Supply voltage

Supply voltage U_s ..... AC / DC 24 V
Frequency range U_s ..... 0 / 40 . . . 60 Hz
Operating range U_s ..... AC 18 . . . 28 / DC 18 . . . 30 V
Power consumption ..... ≤3 VA
Voltage failure without reset ..... ≤ 15 s

Displays and LEDs

Display, characters ..... four lines, 4 x 20 characters
Standard message texts in ..... 20 languages
Alarm addresses ..... ≤ 150
Programmable text messages 200
History memory (messages) 250
Standard text message ..... 3 x 20 characters
Additional text message (press button to access) ..... 3 x 20 characters
Alarm LEDs (a set of LEDs) ..... NORMAL (green), WARNING (yellow), ALARM (red)
Menu texts ..... German/ English
Buttons ..... 5 (ISOMETER test, buzzer mute, additional text, scroll, menu)
Buzzer
Buzzer message ..... can be acknowledged, adoption of characteristics of new value
Buzzer interval ..... configurable
Buzzer frequency ..... configurable
Buzzer repetition ..... configurable

Inputs (MK2430…-11 only)

Digital inputs ..... 12 (IN1 . . . IN12)
Galvanic separation ..... yes
Activation of the digital inputs ..... via potential-free contacts / extraneous voltage
Operating principle ..... N/O / N/C operation individually selectable for each input
Factory setting ..... N/O operation
Voltage range (high) ..... AC / DC 10 . . . 30 V

Voltage range (low) ..... AC / DC 0 . . . 2 V
Recommended cable..... min. J-Y(St)Y 0.8
Cable length..... ≤ 500 m

Interfaces

Interfaces..... RS-485 and USB (V2.0/V1.1)
Technical data for the RS-485 interface:
Protocol ..... BMS
Baud rate ..... 9.6 kbit/s
Cable length..... ≤ 1200 m
Recommended cable: twisted pair, one end of shield connected to PE: J-Y(St)Y min. 2x0.8
Terminating resistor ..... 120 Ω (0.25 W) can be connected via DIP switch
Device address, BMS bus..... DIP switch 1 . . . 150
Factory setting device address ..... 1 (master)

Programming

Interfaces..... RS-485 or USB (V2.0/V1.1), USB cable: Type A plug on type B plug.
Software..... TMK-SET V 3.0 and higher
Factory setting password ..... activated

Max. cable length in case of power supply of 1/2/3 MK24…from one AN450

0.28 mm^2 (z.B. J-Y(St)Y n x 0.6) ..... 160 / 40 / -- m
0.5 mm^2 (z.B. J-Y(St)Y n x 0.8) ..... 250 / 70 / -- m
0.75 mm^2..... 400 / 100 / -- m
1.5 mm^2..... 800 / 210 / 10 m
2.5 mm^2..... 1300 / 360 / 20 m

Max. cable length in case of power supply of 1/2/3 MK24…from one AN410

0.28 mm^2 (z.B. J-Y(St)Y n x 0.6) ..... 300 /150 / 100 m
0.5 mm^2 (z.B. J-Y(St)Y n x 0.8) ..... 500 / 250 / 150 m
0.75 mm^2..... 750 / 375 / 250 m
1.5 mm^2..... 1500 / 750 / 500 m
2.5 mm^2..... 2500 / 1200 / 750 m

Colours

Front foil..... RAL 7035 (light grey); RAL 7040 (basalt grey)
Marking..... RAL 5005 (ultramarine blue)
Front plate ..... RAL 7035 (light grey)

Switching elements (MK2430…-11 only)

Number ..... 1 changeover contact
Function ..... programmable
Operating principle ..... N/C or N/O operation (programmable)
Electrical service life under rated operating conditions ..... 10.000 switching operations
Contact data acc. to IEC 60947-5-1

Utilisation category	AC-13	AC-14	DC-12
Rated operational voltage	24 V	24 V	24 V
Rated operational current	5 A	3 A	1 A

Minimum contact rating ..... 1 mA at AC / DC > 10 V

General data

EMC immunity ..... acc. to EN 61000-6-2:2002-08
EMC emission ..... acc. to EN 61000-6-6:2007-09
Classification of climatic conditions acc. to IEC 60721:
Stationary use 3K5
Transport 2K3
Long-term storage 1K4
Operating temperature ..... -5 . . . +55 °C
Classification of mechanical conditions acc. to IEC 60721:
Stationary use 3M4
Transport 2M2
Long-term storage 1M3
Operating mode ..... continuous operation
Mounting ..... display-oriented
Connection pluggable screw terminals

Connection properties (supply voltage, BMS bus):

Connection of single conductors
rigid/flexible/conductor sizes ..... 0.2 . . . 0,2 . . . 2.5 mm^2/AWG 24-12
flexible with ferrules, without/with plastic sleeve ..... 0.25 . . . 2.5 / 0.25 . . . 2.5 mm^2
Multi-conductor connection (2 conductors with the same cross section)
rigid / flexible ..... 0.2 . . . 1 / 0.2 . . . 1.5 mm^2
flexible with ferrule without plastic sleeve ..... 0.25 . . . 1 mm^2
flexible with TWIN ferrule with plastic sleeve ..... 0.5 . . . 1.5 mm^2

Connection properties (inputs):

Connection of single conductors
rigid/flexible/conductor sizes ..... 0.08 . . . 1.5 / 0.08 . . . 1.5 mm^2/AWG 28-16
flexible with ferrules, without/with plastic sleeve ..... 0.25 . . . 1.5 / 0.25 . . . 0.5 mm2
Multi-conductor connection (2 conductors with the same cross section):
rigid / flexible..... 0.08 . . . 0.5 / 0.08 . . . 0.75 mm^2
flexible with ferrule without plastic sleeve..... 0.25 . . . 0.34 mm^2
flexible with TWIN ferrule with plastic sleeve ..... 0.5 mm^2

Stripping length..... 7 mm
Tightening torque..... 0.5 . . . 0.6 Nm
Degree of protection, internal components (DIN EN 60529) .....IP50 (surface-mounting type: IP54)
Degree of protection, terminals (DIN EN 60529).....IP20
Flammability class..... UL94V-0
Weight .....flush-mounting < 210 g, surface-mounting< 400 g

9.1.1 Standards

The MK2430 alarm indicator and test combination meets the requirements of the regulations for installation IEC 60364-7-710:2002-11 and DIN VDE 0100-710 (VDE 0100 Teil 710): IEC 60364-7-710 2002-11.

9.2 Ordering information

Type	Description	Art. No.
MK2430-11	Alarm indicator and test combination according to IEC 60364-7-710:2002-11 / DIN VDE 0100-710, featuring a BMS bus and a USB interface , 12 digital inputs, one relay output, alarm texts programmable via interfaces and PC, standard text display. Version: Flush-mounting enclosure	B 9510 0001
MK2430-12	Alarm indicator and test combination according to IEC 60364-7-710:2002-11 / DIN VDE 0100-710, featuring a BMS bus and a USB interface, alarm texts can be programmed via interfaces and PC, standard text display. Version: Flush-mounting enclosure	B 9510 0002

Type	Description	Art. No.
MK2430P-11	As MK2430-11, but programmed in the factory.	B 9510 0003
MK2430P-12	As MK2430-12 but programmed in the factory.	B 9510 0004
MK2430A-11	As MK2430-11, but with surface-mounting enclosure	B 9510 0005
MK2430A-12	As MK2430-12, but with surface-mounting enclosure	B 9510 0006
MK2430PA-11	As MK2430A-11, but programmed in the factory and with surface mounting enclosure.	B 9510 0007
MK2430PA-12	As MK2430A-12, but programmed in the factory and with surface mounting enclosure.	B 9510 0008
MK2430S-11	As 2430-11, but front plate with screw fixing	B 9510 0011
MK2430S-12	As 2430-12, but front plate with screw fixing	B 9510 0012
MK2430-mounting kit, complete	Mounting bracket kit for flash-mounting enclosure for snap on mounting of the MK2430 Mounting kits for cavity wall mounting, panel mounting or DIN rail mounting	B 9510 1000
Flush-mounting enclosure	Flush mounting enclosure included in the scope of delivery of MK2430	B 923 710
MEDICS software	- TMK-SET V 4.x parameterisation software for MK2430, MK800, TM800 - TMK-HISTORY V 3.x for MK2430, MK800, TM800, TM1000 and PRC1470 - USB driver software for MK2430, MK800 and TM800 - MEDISET V1.x parameterisation software for TM1000 and PRC1470	B 9602 0087

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